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[Home](#) > A Deeper Look at the G Factor

A Deeper Look at the G Factor

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Charles Spearman was the first to theorize about *g*, the general underlying intelligence factor that accounted for the variation in performance on all cognitive skill tests. Though the existence of *g* is broadly accepted, the nature of this common factor itself is less well understood.

Below are the three lines of reasoning behind the existence and nature of general cognitive ability in human beings.

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“Mental Energy”

Demonstrating that various mental tasks and skills are highly correlated with one another certainly suggests that a more general intelligence is responsible. But it doesn't answer the question: what *is* intelligence?

One explanation favored by Spearman was that *g* was a blended ability that relied on drawing *relationships between elements*, and manifested as the ability to spot differences, makes inferences and deductions, solve problems, arrive at rules and patterns, and grasp conceptual connections.

General intelligence is not any of these individual abilities, but rather a total “mental energy”

that can be invested into any one of them, possibly with a neurological basis.

The creator of the Wechsler intelligence scales similarly saw g not as a particular skill, but a property of the brain itself, a resource that is tapped into by all cognitive tasks. Arthur Jensen likewise considered general mental ability to be akin to efficiency in processing, rather than the contents of that processing. Both theorists took pains to emphasize that g was not just the average of all tests of mental ability, but the wellspring of ability itself.

Sampling theory

E.L. Thorndike and Godfrey Thomson had an entirely different explanation. They agreed that there was a large overlap between various cognitive abilities, but that this overlap could be explained without the need for the concept of g .

This theory held that IQ tests take different samples from the wide range of uncorrelated mental processes humans engage in. Thus the correlation we see between different tests is a result of overlapping samples of different processes. In other words, we see an overlap because our measurements are not fine enough to distinguish the small variations in unrelated processes. The idea is that factor analysis of different tests merely highlights the common elements in each test rather than that g that is common.

This theory, although subtle, has been statistically shown to explain Spearman's original observations just as well as his theory for g .

Not everyone accepts this sampling theory. One inconsistency is that people with brain damage often present with a specific impairment rather than a general one, which is what you might expect if sampling theory were true.

Mutualism

Some theorists opted for a blended explanation, saying that the brain's various cognitive abilities are indeed separate in the developing brain, but as a person matures, they become more linked. Because separate cognitive abilities can be applied well together to solve real world problems, the unified g we witness is actually a result of the brain being used to drawing on many of its separate abilities at once. In other words, there is no g , but functionally, it would appear that way. If a process is more efficient when paired with another process, they will in time end up being correlated with one another.

As an example, imagine the IQ test question: square is to four as cube is to _____.

You can easily imagine how many separate cognitive abilities could be useful in answering this question – vocabulary and verbal skill, logic, and also a little mathematical skill. It is not that you draw on a single g to answer the question, but rather that your separate skills are so commonly used together they can be measured as such.

One argument against the mutualism explanation, however, is that it doesn't quite account for the variations in heritability we observe in g .

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